INSTRUCTION
MANUAL
NO. 070-6158-00
PRODUCT GROUP 60

TEK PROBE
AND ACCESSORIES

P6135

DIFFERENTIAL PAIR

Tektronix®
COMMITTED TO EXCELLENCE

TEK INSTRUCTION MANUAL

Part No. 070-6158-00
Product Group 60

P6135
DIFFERENTIAL PAIR

Please Check for
CHANGE INFORMATION
at the Rear of This Manual

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SAFETY SUMMARY

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

OPERATOR

Terms In This Manual

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

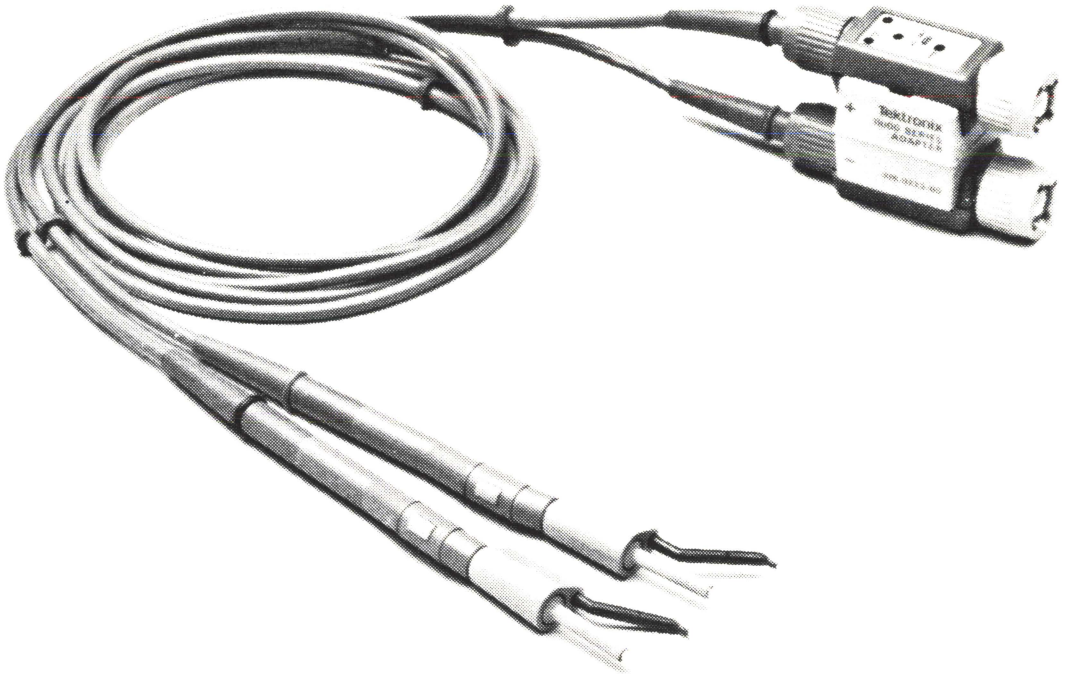
Do Not Operate In Explosive Atmospheres

To avoid explosion, do not operate this product in any explosive atmosphere unless it has been specifically certified for such operation.

SERVICE

Use Care When a Signal Source is Connected

To avoid personal injury, do not touch exposed connections and components while power is connected to a signal source.



6158-1

The P6135 Differential Pair.

SPECIFICATION

DESCRIPTION

The TEKTRONIX P6135 is a 10X passive, differential probe pair with identify functions designed specifically for use with the 11A33 differential plug-in. The pair may also be used with other differential plug-ins or with other oscilloscopes having input impedances of 1 MΩ paralleled by 13 pF to 17 pF. The attenuation ratio is adjustable to 10X (including effects of the input resistance of the amplifier unit).

When one of the probe pair is used by itself, the precisely adjustable attenuation retains the high accuracy typical of differential-comparator measurements.

When the P6135 is used as a differential pair on the inputs of a differential amplifier, the adjustable attenuation ratio compensates for differences in input resistance of the amplifier, thus improving the common-mode rejection ratio (CMRR) of the system.

An adjustable network in the compensation box permits the probe to be compensated for uniform frequency response characteristics, providing a high CMRR from dc to high frequencies, as well as adjustments to optimize transient response.

Use of special low-noise coaxial cable on the probe helps to maintain high system CMRR even when the probes are moved. Probe cables are provided only in a length of 1.5 meters.

The P6135 probe set meets the requirements of UL 1244 and is fully compatible with the Tektronix family of subminiature probe accessories.

ACCESSORIES

The P6135 is shipped with the following standard accessories:

1	Instruction manual
1	Carrying pouch
2	Hook tips
4	Probe tip-to-circuit board connectors
2	Low-inductance ground leads
2	Ground collars with leads
2	Alligator clips
2	Micro hooks
2	Screwdrivers
1	Connector block
2	Cable marker sets
12	Cable clips

Use of these accessories is described in the "Operating Instructions." Part numbers and optional accessories are listed in the "Replaceable Parts List" (Section 5).

PERFORMANCE CONDITIONS

The electrical characteristics listed in Table 1-1 apply when the probe is calibrated between +20°C and +30°C and is used with a calibrated instrument system operating within the environmental conditions stated in Table 1-2.

Items listed in the "Performance Requirement" column are verifiable qualitative or quantitative limits. Items listed in the "Supplemental Information" column are not verified in the "Performance Check Procedure" (Section 3); they are either explanatory notes, calibration setup descriptions, performance characteristics for which no absolute limits are specified, or characteristics that are impractical to check.

Table 1-3 lists the probe's physical characteristics.

Table 1-1
Electrical Characteristics

Characteristic	Performance Requirement	Supplemental Information
Attenuation (System)	Adjustable to 10X.	Oscilloscope input resistance must be 1 MΩ ±1% at dc.
Input Impedance (System)	1 MΩ ±1%.[a] 11.3 pF +1.6 pF, -1.0 pF.[a]	Probe connected to instrument and properly compensated. See Figure 1-1 for a graph of input impedance magnitude and phase versus frequency.

[a] Performance requirement not checked in manual.
[b] BOL = beginning of life.

Table 1-1 (cont)
Electrical Characteristics

Characteristic	Performance Requirement	Supplemental Information
Compensation Range	13 pF to 17 pF.[a]	
System Bandwidth (−3 dB)	DC to 150 MHz (with 11A33).[a]	Oscilloscope bandwidth should be at least 155 MHz. Probe must be properly low- and high-frequency compensated.
Rise Time (System)	<2.33 ns (with 11A33). Calculated from bandwidth: $t_r = 0.35/BW$.	
CMRR (System) (Probe pair with 11A33)	10,000:1 from DC to 1 kHz, decreasing to 100:1 at 20 MHz.	See Figure 1-3 for a graph of CMRR vs frequency.
Maximum Nondestructive Input Voltage	500 V (dc + peak ac) to 1.3 MHz derated to 50 V (dc + peak ac) at 100 MHz.[a]	See Figure 1-2 for derating curve.

[a] **Performance requirement not checked in manual.**

Table 1-2
Environmental Characteristics

Characteristic	Information
Temperature Range (Operating)	0°C to +50°C (+32°F to +122°F).
Temperature Range (Non Operating)	−55°C to +75°C (−67°F to +167°F).
Humidity	Five cycles (120 hr.) at 95% to 97% relative humidity.
Altitude (Operating)	To 4,500 m (15,000 ft).
Altitude (Non Operating)	To 15,000 m (50,000 ft).
Packaged Product Vibration and Shock (Transportation)	Qualifies under National Safe Transit Association's Pre-shipment Test Procedures; 1A-B-1.

Table 1-3
Physical Characteristics

Characteristic	Information
Net Weight (includes accessories, excludes packaging)	~220 g (7.8 oz).
Probe Cable Assembly Length	~1.5 m (4.9 ft).

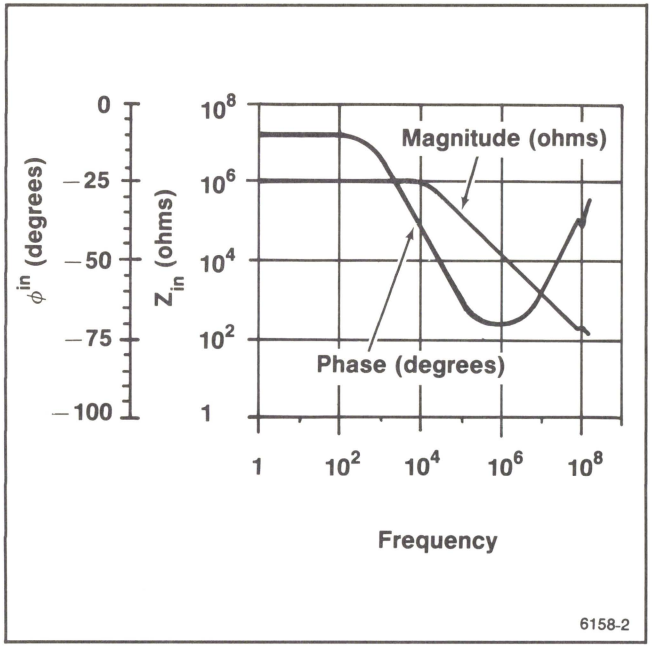


Figure 1-1. Typical input impedance.

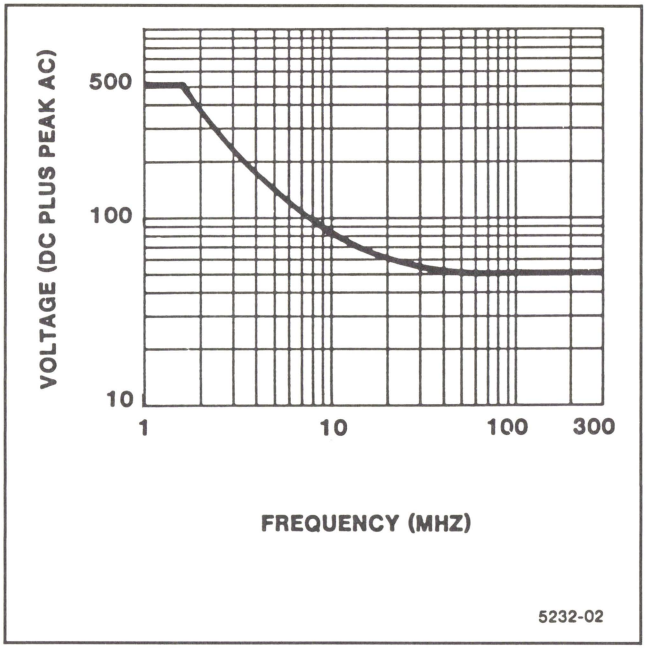


Figure 1-2. Typical voltage derating versus frequency.

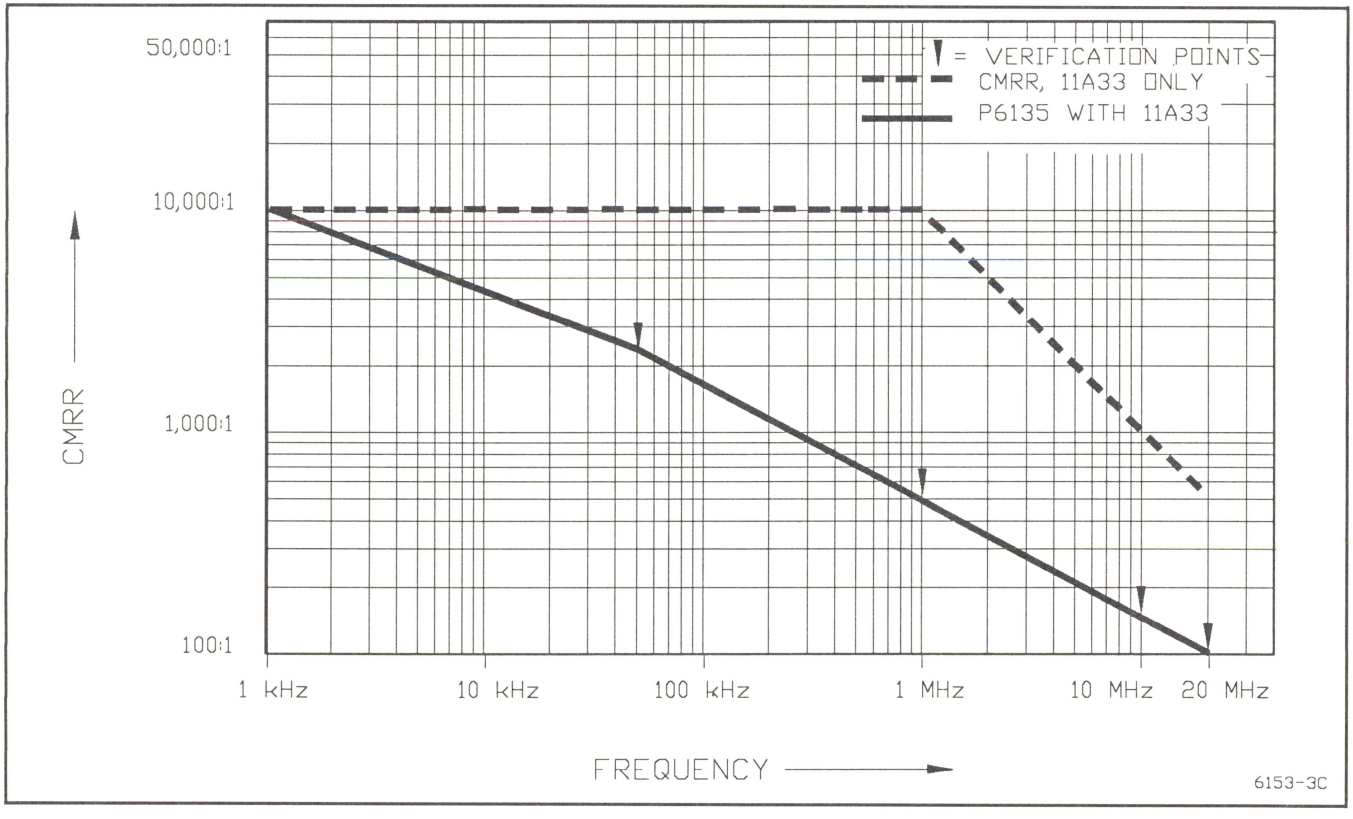


Figure 1-3. P6135 Probe CMRR versus frequency (with 11A33).

OPERATING INSTRUCTIONS

This section of the manual is intended to familiarize the operator with the use of the P6135 Probe. Included are descriptions of connectors and accessories. Also included is information on probe tips and measurement considerations.

NOTE

Upon receipt, save the shipping and packaging materials for reuse should reshipment become necessary. Refer to "Maintenance" (Section 4) for further information.

PROBE HANDLING

The P6135 subminiature probe bodies have been designed for ease of use when probing small circuitry. Both the probes themselves and their accessories should be handled carefully at all times. Avoid dropping the probe bodies, since damage to the tips may result. Exercise care to prevent crushing the cables or placing excessive strain on them by pulling.

CONTROLS AND CONNECTIONS

The following information describes the location and function of the P6135 connections (refer to Figure 2-1).

(1) **Ground Collar with Lead** — Can be connected to the alligator clip, the micro-hook, or directly onto a square-pin ground on a circuit board.

(2) **Probe Tip** — Used to acquire the signal from the circuit under test.

(3) **ID Button** — Activates the ID function in the host instrument. Pressing the ID button can also execute a sequential step through a programmed test routine on oscilloscopes equipped to do so.

(4) **TEKPROBE™ Interface (Level 1)** — Provides connections (through the input connector) for signal, attenuation readout factor, and function triggering between the probe and the host instrument if the host instrument is so equipped.

(5) **BNC Locking Ring** — Locks the probe onto the instrument. To install, first check that the locking ring is fully counter-clockwise as viewed from the rear of the compensation box. Insert the probe onto the front-panel connector. To lock the probe onto the instrument, rotate the locking ring clockwise until the probe is secured to the instrument.

(6) **Low Inductance Ground Lead Assemblies** — Provide the lowest inductance ground connections for best probe performance.

DESCRIPTION OF STANDARD ACCESSORIES

Both standard and optional accessories for the P6135 are listed in the "Replaceable Parts List" near the back of this manual. Standard accessories (that have not been previously described in "CONTROLS AND CONNECTIONS"), are described in the following paragraphs, and are illustrated in Figure 2-1. Part numbers are listed in "Replaceable Parts" on page 5-4.

Circuit-Board-to-Probe-Tip Connectors

Four circuit-board-to-probe-tip connectors are provided for making permanent probe test points on circuit boards. These connectors provide extremely short signal and ground paths to minimize ringing. Before inserting the probe tip into a connector, remove both the light-grey probe-body shell and the grounding collar from the probe head.

Connector Block

The connector block holds the two probes together at the correct spacing for use on differential and other inputs of 11000-Series plug-ins. It allows the two probes to be separated to be used on other differential amplifiers or as individual probes on other plug-ins. The connector block is installed by snapping the probes into it from the side (see Figure 2-1).

Cable Connector Clips

The cable connector clips hold the cables in consistent relationship with each other to minimize movement and interaction so as to optimize CMRR measurements.

Cable Markers

Cable markers are provided in several different colors to help identify specific probes when using multi-channel oscilloscopes.

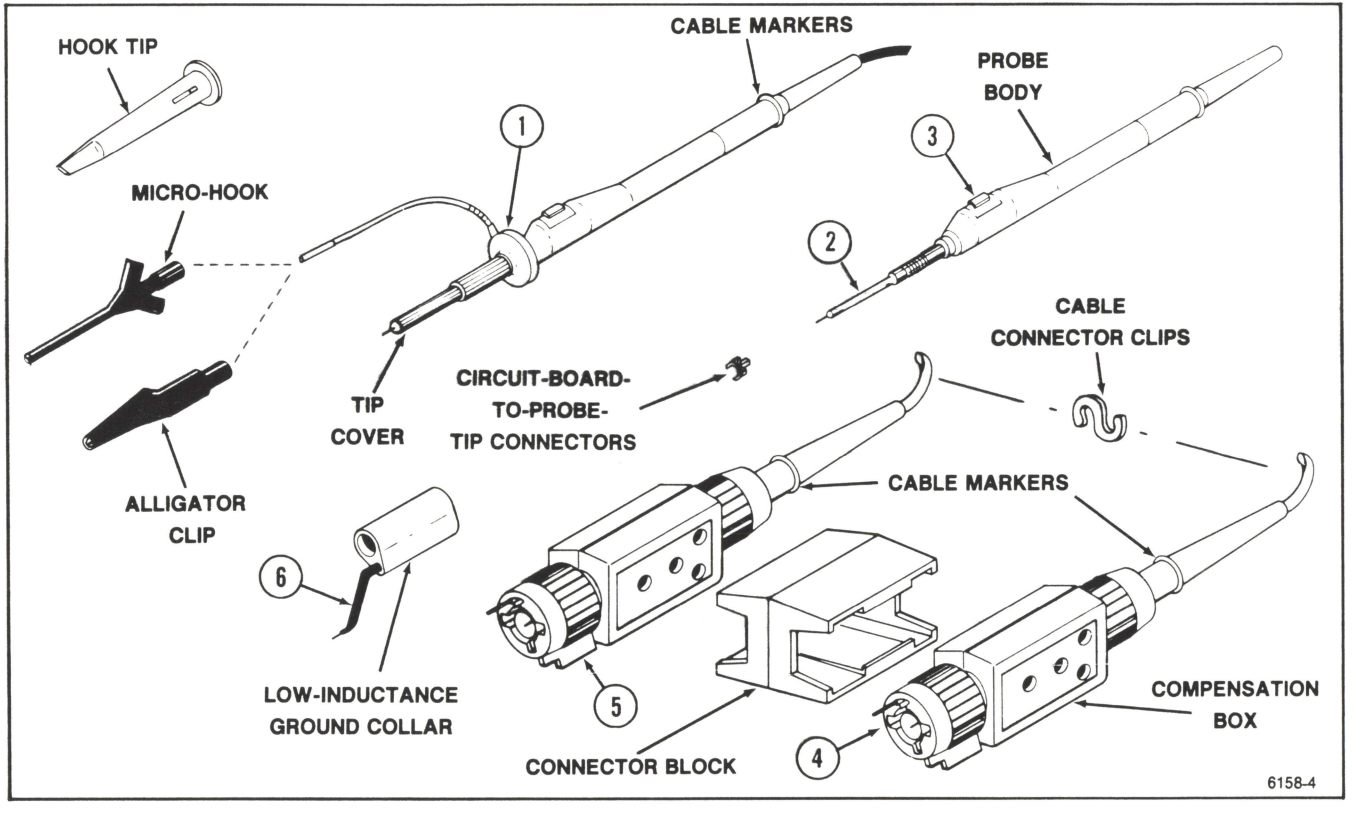


Figure 2-1. Controls, connectors, and probe accessories.

Alligator Clips

The ground leads plug into the alligator clips which are used for making connections to ground pins or other surfaces.

Hook Tips

The hook tip provides a means of making a hands-free connection to a test point or component lead. To install a hook tip just slide it onto the probe tip. (Hook tips can not be used with the low-inductance ground lead.)

Micro Hooks

The ground leads plug into the micro-hooks which are used for making connections in tight places.

Screwdriver

The screwdriver (not shown) is designed specifically for use in making probe compensation adjustments.

Carrying Pouch

The carrying pouch (not shown) is useful for transporting the probe set, accessories and manual.

OPERATING CONSIDERATIONS

Probe Compensation

Differential applications require careful matching of both channels of the differential measurement system. In calibrating a probe pair to obtain optimum CMRR, the adjustments compensate for imbalances in the differential amplifier as well as between the probes themselves. The probes will meet specification only when used on the inputs to which they are adjusted. If the probes are interchanged on the differential amplifier inputs or moved to another instrument, recalibration is necessary. This is true even when using them in a non-differential mode.

Calibration is not difficult but must be done properly to achieve the high CMRR characteristics. Adjustment procedures for using the P6135 probes singly or in pairs for differential applications, may be found in Section 3 of this manual.

CMRR Considerations

Common-mode signals are signals or respective parts of signals which are identical in amplitude, frequency, and phase. A differential amplifier rejects common-mode signals. The degree of rejection depends primarily on the symmetry of the amplifier and the signal path. CMRR (common-mode rejection ratio) refers to the degree of rejection of common-mode signals, and is expressed as a ratio. For instance, 10,000:1 would be the CMRR if 10 volts of common-mode signal at the inputs resulted in 1 millivolt at the output.

The specified CMRR of a system assumes that the points being measured have identical source impedances. The measurement system input impedance represents a loading effect on the source, and thus affects the common-mode signal voltage as seen by the system. Measurement points having a significant difference in source impedance will present an unbalanced common-mode signal to the test system, thereby degrading CMRR performance.

A major advantage to using the P6135 probe set with the differential amplifier is that loading is reduced at mid-to-high frequencies because of lower input capacitance, and the effect of source impedance differences is reduced. Because of this, probe compensation adjustments may have sufficient range to adjust to a balance even in the presence of source impedance differences. An application method of achieving this is as follows: (a) Compensate the probes for the best CMRR with both probe tips connected to the same test point. Identify the nature of the common-mode signal at this time. (b) Connect the probe tips to the desired test points and recompensate for the best CMRR. Make sure that the adjustments are attenuating only the common-mode signal. The best CMRR can be obtained by making final adjustments with the signal to be measured. (c) This procedure may degrade CMRR performance for other frequencies, so recompensation is recommended when changing frequencies or when moving to other test points.

Dynamic Range Effects

Another advantage when using the P6135 for differential measurements is the extended dynamic range. Because of the 10X attenuation of the probes, the dynamic range for CMRR measurements of the amplifier is effectively increased by a factor of 10. This increase in range applies at all frequencies and settings of the Volts/Div switch, up to the bandwidth and input voltage ratings of the system.

Probe Grounding

When using a P6135 probe set in a low frequency (<1 MHz) CMRR measurement, neither probe should be grounded to the equipment under test. Instead, the probe

shields should be connected together at the probe body (refer to Figure 2-2). This degrades high frequency performance, but reduces the effect of ground-loop currents which can degrade low-frequency CMRR.

For high frequency (> 1 MHz) measurements, the probes should be grounded to the equipment under test (refer to Figure 2-3). The ground leads should be as short as possible (see Figures 2-4 and 2-5 for additional information on probe grounding).

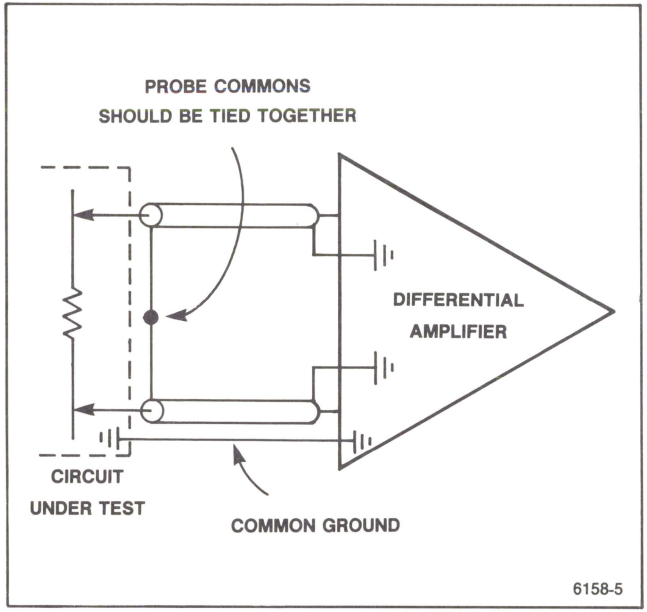


Figure 2-2. Probe ground connection for optimum LF CMRR performance.

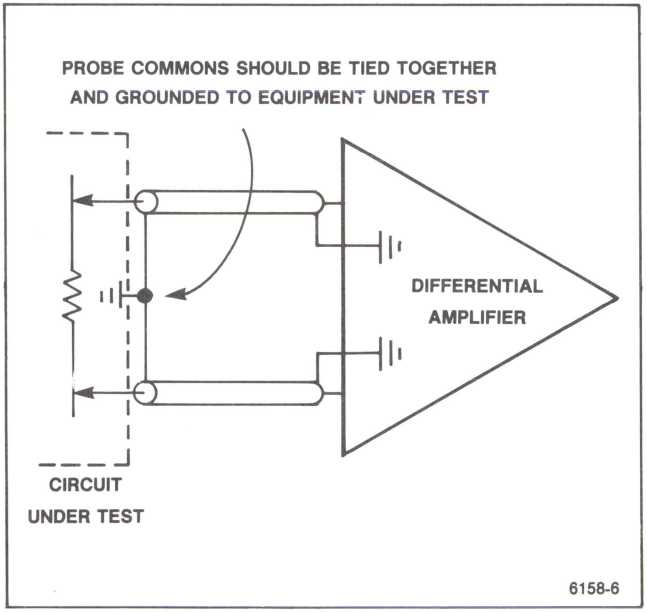
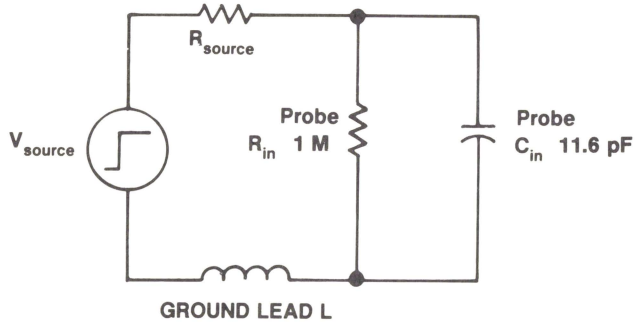
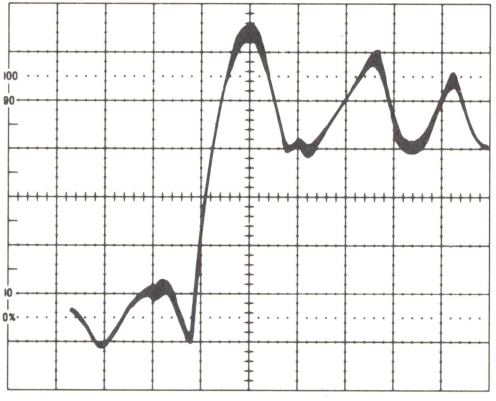


Figure 2-3. Probe ground connection for optimum HF CMRR performance.



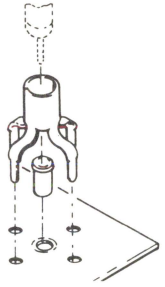


P6135 with 6″- ground lead, Tr = 4 ns.

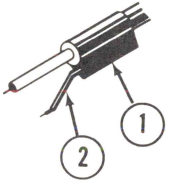
Ground lead inductance can significantly reduce the performance of a probe. As shown in the model above, the ground lead inserts a series inductance into the signal path forming a series-resonant circuit between C_{in} of the probe and ground lead L, with only R_{source} as damping. This forms a resonant circuit with $f_o = 1 \div (2\pi \sqrt{LC})$. A six inch ground lead has ~150 nH of self inductance causing an f_o of ~120 MHz, which is within the frequency response of the instrument. This greatly degrades risetime, bandwidth, and transient accuracy (see illustration). For best results, make sure that ground lead inductance is minimized. Three methods for doing so are described on the following page.

6158-7

Figure 2-4. Damaging effects of ground-lead inductance.



ECB to Probe-Tip Adapters provide high quality connection test points when installed on circuit boards. The ribbed plastic tip cover on the probe must be removed. The probe will then plug into the test point directly. Adapters are available in bags of 100 (see "Replaceable Parts").



The low-inductance lead provided with the P6135 allows for a substantial reduction of ground lead L (~32 nH instead of 150 nH). To use, unscrew and remove the ribbed tip cover and slide off the ground collar with ground lead. Slip on the low-inductance ground lead collar (1) and reinstall the ribbed plastic tip cover. Install the low-inductance lead (2) from the accessory pack.

The Tektronix Klipkit (optional, see "Replaceable Parts)", provides a hands-off connection of signal and ground to an IC (up to 16 pins). Klipkit ground is acquired by inserting a connecting pin (included) into the Klipkit at the proper pin location. The probe body will then make ground contact when inserted into the other contact locations.

6027-3

Figure 2-5. Reducing the damaging effects of ground-lead inductance.

PERFORMANCE CHECK AND CALIBRATION PROCEDURE

PURPOSE

The "Performance Check and Calibration Procedures" are used to verify the P6135's Performance Requirements as listed in "Specification" (Section 1), and to make adjustments if necessary. This procedure may also be used as an acceptance check.

TEST EQUIPMENT REQUIRED

Test equipment described in Table 3-1 is a complete list of equipment required to accomplish the following procedures. Test equipment recommended is the minimum necessary to provide accurate results; therefore, substitute equipment must meet or exceed the specifications of the equipment listed. Detailed operating instructions for test equipment are not contained in this procedure. Should additional operating information be needed, refer to the appropriate test equipment instruction manual.

LIMITS AND TOLERANCES

The limits and tolerances given in this procedure are for the P6135 probes under test. Test equipment error is not included except as noted.

PREPARATION

Before proceeding with checks, allow sufficient warm-up time for test equipment to stabilize (typically 20 minutes).

Table 3-1
Test Equipment Required

Item Description	Purpose	Recommended Example
1. Oscilloscope System	Signal display.	A Tektronix 11000-Series Oscilloscope with 11A33 Differential Plug-in.
2. Calibration Generator	HF Compensation.	Tektronix PG506[a] or equivalent.
3. Leveled Sine-Wave Generator	CMRR checks.	Tektronix SG503[a] or equivalent.
4. Probe Tip-to-BNC Adapters (2)	Signal pickoff.	Tektronix Part Number: 013-0195-00 or equivalent.
5. Adapter: BNC-T	CMRR adjustments.	Tektronix Part Number: 103-0030-00 or equivalent.

[a] **Requires TM500- or TM 5000-Series mainframe.**

Table 3-1 (cont)
Test Equipment Required

Item Description	Purpose	Recommended Example
6. Precision Coaxial Cable	Signal interconnection.	Tektronix Part Number: 012-0482-00 or equivalent.
7. Adapter: BNC Female-to-BNC-Female	Signal interconnection.	Tektronix Part Number: 103-0028-00 or equivalent.
8. 10X Attenuator BNC, 50Ω	HF compensation.	Tektronix Part Number: 011-0059-02 or eqivalent.
9. Termination, 50Ω	Signal termination.	Tektronix Part Number: 011-0049-01 or equivalent.
10. Low-Reactance Alignment Tool (Supplied With Probe)	Compensation Adjustments	Tektronix Part Number: 003-1364-00 or equivalent.

ABRIDGED PROCEDURES

The following abridged procedures may be used as a performance check or a calibration guide by the experienced technician.

Procedure 1

Use this procedure to check and adjust probe performance for single-ended applications.

a. Check (and adjust if necessary) dc attenuation to a precise 10X.

b. Check (and adjust if necessary) probe low-frequency compensation. Probe compensation range is 13 to 17 pF.

c. Check (and adjust if necessary) probe high-frequency compensation.

Procedure 2

Use this procedure to check and adjust for common-mode (2 probes) applications.

a. Check (and adjust if necessary) dc attenuation. Adjust either probe to balance out the common-mode component.

b. Check (and adjust if necessary) low- and high-frequency compensation. Adjust either probe to achieve minimum display amplitude.

c. If necessary, repeat steps to eliminate interaction.

DETAILED PROCEDURES

Procedure 1 (Single-Ended Applications)

Use the following checks to verify and adjust probe performance for single-ended applications. Check each probe separately (one on each input). These checks are written for the probe on the + Input. Reverse the input designations (where it says + Input, use − Input etc.) when checking or adjusting the second probe. Also, keep in mind that the displays for the probe on the − Input will be inverted compared to those for the probe on the + Input. The input coupling on the unused input should be set to ground or off.

1. Check and Adjust DC Attenuation

Equipment Required (see Table 3-1):

Oscilloscope System (Item 1)
Probe-to-BNC Adapter (Item 4)
Precision Coaxial Cable (Item 6)

a. Connect the equipment as shown in Figure 3-1 and set the controls as follows:

Differential Comparator:

Comparison V_c	+5.000
+Input	GND or OFF
−Input	GND or OFF
Volts/Div	10 mV
Position	Centered

Oscilloscope:

Calibrator	5 V, 1 kHz

Time Base:

Time/Div	1 ms
Triggering	Auto, Triggered Display

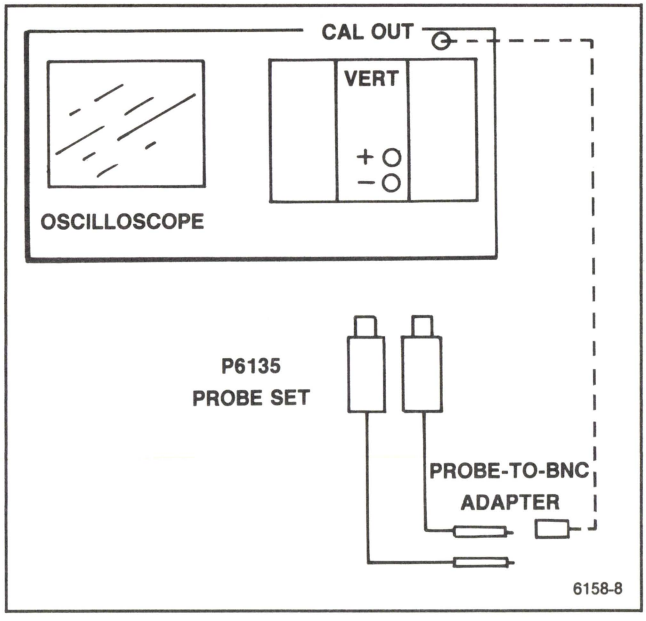


Figure 3-1. Setup for dc attenuation and LF compensation checks and adjustments.

b. Position the trace to center graticule line.

c. Change the +Input to DC and the −Input to V_C. Connect the calibrator output directly to the +Input connector with the coaxial cable.

d. Adjust the Comparison Voltage to set the top of the calibrator waveform on the center graticule line. Note the V_C reading. Remove the connection from +Input to the calibrator output.

e. Connect the probe to the +Input and the probe tip to the Calibrator output using a probe tip-to-BNC adapter. Set the Volts/Div for 10 mV/div. (at the probe tip) and both the + and −Inputs to GND. Position the trace to the center graticule line, then change the +Input to DC and the −Input to V_C. Set V_C to the same voltage as noted in step d.

f. CHECK — that the top of the calibrator waveform is on the center graticule line.

g. ADJUST — if necessary, DC ATTEN in the compensation box to set the top of the calibrator waveform to the center graticule line.

h. Repeat steps a through g for the other probe (reverse the input designations in the instructions).

2. Check and Adjust LF Compensation

Equipment Required (see Table 3-1):

Oscilloscope System (Item 1)
Probe-to-BNC Adapter (Item 4)

a. Connect the equipment as shown in Figure 3-1 and set the controls as follows:

Differential Comparator:

+Input	DC
−Input	GND or OFF
Volts/Div	100 mV (at probe tip)
Bandwidth	Full (or select appropriate bandwidth limit)
Position	Centered

Oscilloscope:

Calibrator	0.5 V, 1 kHz

Time Base:

Time/Div	0.2 ms
Triggering	Auto, Triggered Display

b. Connect the probe tip to the Calibrator Output through a probe tip-to-BNC adapter.

c. Center the display.

d. CHECK — for a flat top display.

e. ADJUST — if necessary, LF COMP in the compensation box for a flat top display.

NOTE

If the P6135 has been subjected to large temperature variations or mechanical shock, or has had either its comp box, cable, or probe tip replaced, the LF COMP adjustment may no longer be centered to provide adequate range to LF compensate the probe and the following procedure must be performed:

1. Adjust the LF COMP capacitor to the center of its range.
2. Carefully remove the identification marker with tweezers or other sharp instrument (see Figure 4-1).
3. Adjust C4 for a flat-top display.
4. Install a new identification marker (included in the accessory pack).
5. Allow C4 to settle for 20 minutes before proceeding with the common-mode calibration (Procedure 2).

f. Repeat steps a through e for the other probe (reverse the input designations in the instructions).

3. Check and Adjust HF Compensation

Equipment Required (see Table 3-1):

Oscilloscope System (Item 1)
Calibration Generator (Item 2)
Probe-to-BNC Adapter (Item 4)
Termination, 50 Ω (Item 9)

a. Connect the equipment as shown in Figure 3-2 and set the controls as follows:

Calibration Generator:

PERIOD	10 μs (100 kHz)
AMPLITUDE	Set for a 5 Division Display
Mode	FAST RISE

Oscilloscope:

Volts/Div.	200 mV (at probe tip)
Input Coupling	DC
Bandwidth	Full

Time Base:

Time/Div.	20 ns/div.
Triggering	Internal

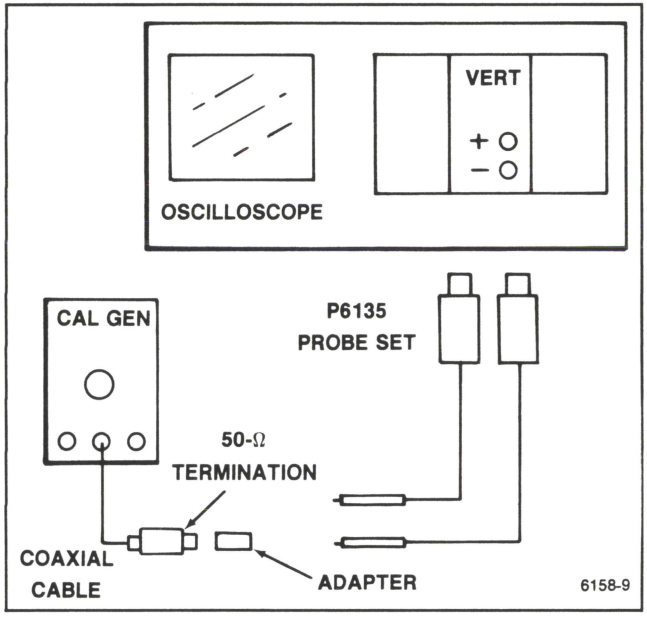


Figure 3-2. Setup for HF compensation check and adjustment.

b. Connect the probe tip to the +OUTPUT of the square-wave generator using a 50 Ω termination and probe tip-to-BNC adapter.

c. Position, trigger and adjust the display for 5 divisions.

d. CHECK — for a system risetime of <2.33 ns (oscilloscope bandwidth must be >155 MHz).

e. ADJUST — if necessary, HF ADJUST 1 for best overall flat response.

f. ADJUST — if necessary, HF ADJUST 2 for a square front corner.

g. Repeat steps a through f for the other probe (reverse the input designations for this check, remembering that the display is inverted).

Procedure 2 (Common-Mode Applications)

Use this check to verify and adjust probe performance for (2-probe) common-mode applications. Please refer to Figure 3-3.

NOTE

Before proceeding, it is recommended that the CMRR of the differential amplifier be checked to ensure that it meets its performance requirements.

It is also recommended that the cable clips be installed to minimize cable interaction during CMRR applications.

Procedure 1 should be performed seperately for each of the two probes before proceeding.

Equipment Required (see Table 3-1):

Oscilloscope System (Item 1)
Leveled Sine-Wave Generator (Item 3)
Probe-to-BNC Adapters (2) (Item 4)
BNC-T Adapter (Item 5)
Precision Coaxial Cable (Item 6)
BNC Female-to-BNC Female Adapter (Item 7)

1. Check and Adjust DC ATTEN

a. Connect the test setup as shown in Figure 3-3 except initially connect the BNC-T adapter to the oscilloscope calibrator output instead of to the leveled sine-wave generator. Set the controls as follows:

Differential Comparator:

+Input	DC
−Input	DC
Volts/Div	10 mV (at probe tip)
Position	Centered

Oscilloscope:

Calibrator	5 V, 1 kHz

Time Base:

Time/Div.	200 μs/div.
Triggering	Auto, Triggered Display

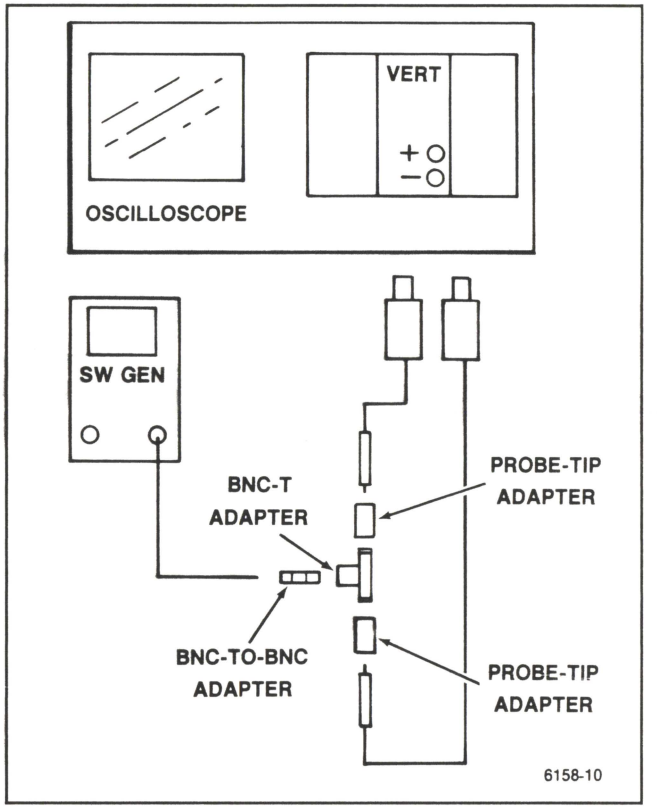


Figure 3-3. Setup for CMRR checks and adjustments.

b. Center the display.

c. ADJUST — the DC ATTEN of either probe to balance out the square wave component. Disregard any remaining spikes at this time.

2. Check and Adjust LF COMP and HF ADJUST

a. Connect both probe tips to the output of the leveled sine-wave generator as shown in Figure 3-3 and set the controls as follows:

Differential Comparator:

+Input	DC
−Input	GND or OFF
Volts/Div	2 V (at probe tip)
Bandwidth	Full or 100 MHz
Position	Centered

Time Base:

Time/Div.	20 μs/div.
Triggering	Auto, Triggered Display

Leveled Sine-Wave Generator:

FREQUENCY	50 kHz
AMPLITUDE	10 V (5 Divisions)

b. Adjust the generator amplitude for 5 divisions.

NOTE

The signal generator is not terminated into 50 Ω with this setup, so the output amplitude is two times the front panel reading.

c. Change the −Input to DC and the Volts/Div to 10 mV/Div. Center the display.

d. ADJUST — the LF COMP of either probe to obtain minimum display amplitude.

e. Change the sine-wave generator frequency to 10 MHz and the Time/Div to .1 μs.

f. ADJUST — HF ADJ 1 on either probe to obtain minimum display amplitude.

g. Change the generator frequency to 20 MHz and the Volts/Div to 2 mV (20 mV with 10X probe attenuation).

h. ADJUST — HF ADJ 2 on either probe to obtain minimum display amplitude.

i. Repeat steps e through h two or three times to achieve optimum performance.

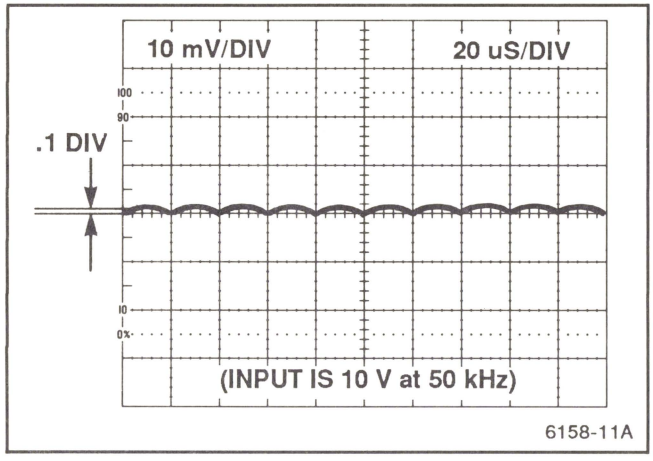


Figure 3-4. Typical CMRR display after adjustment.

Table 3-2
Verification Points for CMRR
(with 11A33)

Signal Generator Frequency	50 kHz	1 MHz	10 MHz	20 MHz
Amplitude	10 V	10 V	10 V	10 V
Volts/Div (At Probe Tips)	10 mV	10 mV	10 mV	20 mV
Time/Div (Oscilloscope)	20 μs	1 μs	0.1 μs	0.05 μs
Amplitude (Display)	$\leqslant$.43 div	$\leqslant$2 div	$\leqslant$7.1 div	$\leqslant$5 div
CMRR	2300:1	500:1	140:1	100:1

NOTE

Some interaction exists between the LF, HF and DC adjustments. Repeat the adjustment sequence two or three times to achieve the best results. Because of slight differences between them, there will be a favored combination of probes and instrument inputs that will achieve maximum CMRR.

The P6135 Differential Pair is now calibrated for use in common-mode signal applications if used on the same inputs for which it was calibrated. If the probes are interchanged or moved to a different amplifier, they must be recalibrated for optimum CMRR.

MAINTENANCE

This section contains information for performing preventive and corrective maintenance, and instrument repackaging instructions.

PREVENTIVE MAINTENANCE

WARNING

To prevent electric shock or shorting of components, do not perform preventive probe maintenance while the probe is connected to a signal or voltage source.

Preventive maintenance consists primarily of cleaning and visual inspection. When performed on a regular basis, preventive maintenance can prevent instrument breakdown and may improve instrument reliability. The frequency of maintenance depends on the severity of the environment. A convenient time to perform maintenance is just before a performance check and calibration.

CLEANING

CAUTION

Avoid the use of chemical cleaning agents which may damage the plastics and circuit board used in the probe. In particular, avoid chemicals which contain benzene, toluene, xylene, acetone, MEK, or similar solvents. For additional information on recommended cleaning agents, consult your Tektronix Service Center or representative.

Exterior

Loose dust accumulated on the outside of the probe can be removed with a soft cloth or a small brush. Dirt which remains can be removed with a soft cloth dampened in a mild detergent and water solution. Do not use abrasive cleaners.

Interior

Cleaning the interior of the probe should not be necessary. Normally, the probe compensation box circuit board will not require cleaning unless a cover has been removed for an extended period of time. The best way to clean the interior is to blow off the accumulated dust with dry, low-velocity air (about 9 lb/sq. in). Remove any dirt which remains with a soft brush or a cloth dampened with a nonresidue-type cleaner, preferably isopropyl alcohol. A cotton-tipped applicator is useful for cleaning in narrow spaces or for cleaning more delicate circuit components.

VISUAL INSPECTION

Occasionally inspect the P6135 for such defects as broken connections, damaged parts, bent leads, and heat-damaged components.

CORRECTIVE MAINTENANCE

Corrective maintenance consists of replacing a defective component or assembly. Special techniques required to replace components are given here.

WARNING

To prevent electric shock or shorting of components, do not perform any probe maintenance while the probe is connected to a signal or voltage source.

OBTAINING REPLACEMENT PARTS

Special Parts

Most of the parts and assemblies in this probe are specifically made or selected by Tektronix, Inc. to meet specific performance requirements. Order all parts directly from your local Tektronix Field Office or representative.

Ordering Parts

When ordering, and to ensure receiving the proper parts or assemblies, include all of the following information with your order:

1. Probe type (including modification or option numbers).

2. Description of the part (if electrical, include the circuit number).

3. The Tektronix part number.

ASSEMBLY REPLACEMENT

Compensation Box Replacement and Disassembly

The compensation box is available as a complete replaceable part. Individual components inside the compensation box are not replaceable. However, the box must be disassembled to replace the cable assembly or the compensation box.

Use the following procedure to disassemble the compensation box (refer to Figure 4-1).

a. Pry off the BNC connector shell using a screw driver or a long, flat tool.

b. Remove the cable retainer nut by turning one-quarter turn and pulling it straight away from the compensation box body.

c. Lift the label side of the compensation box up. Note the orientation of the circuit board.

Cable Replacement

Use the following procedure to replace the cable assembly and reassemble the compensation box.

NOTE

When ordering a replacement cable from the replaceable parts list, you will receive a pair of cables. To ensure the best CMRR performance, replace the cables on both probes.

a. Remove the defective cable.

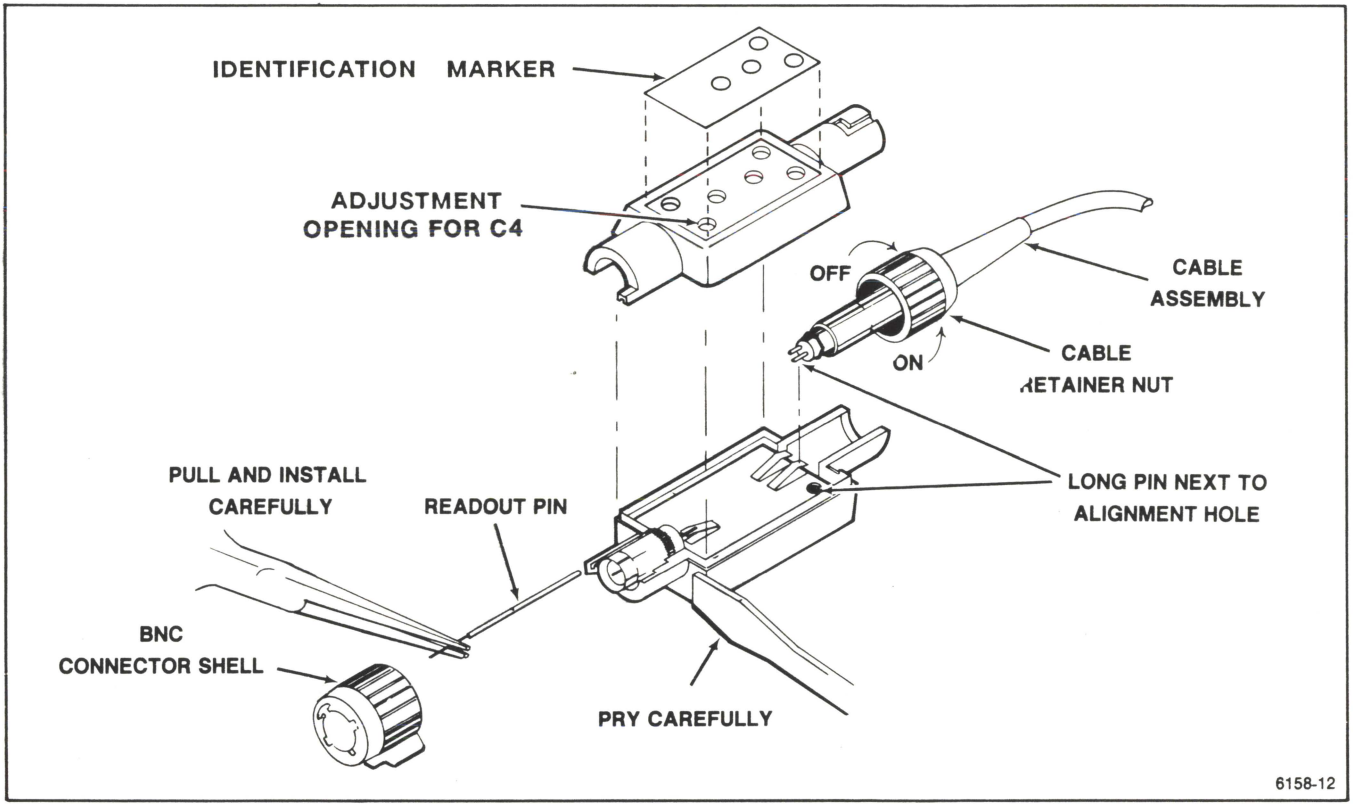


Figure 4-1. Disassembly of compensation box.

b. Place the cable retainer nut over the new cable and set the new cable assembly into its place in the bottom compensation-box half. Set the long pin of the cable end so that it is nearest the alignment hole. Make certain that the connector pins on the cable and the BNC connector *push down* on the leaf springs before installing the compensation-box top half. While holding the cable assembly, circuit board, and BNC connector in place, lower the top half of the compensation box onto the lower half.

c. Hold the two compensation-box halves together. Slide the cable-retaining nut up the cable and on to the compensation-box halves. Secure it by turning it one-quarter turn.

d. Push the BNC connector cover onto the front of the compensation-box halves (make certain that the readout-pin is through the proper opening and is not being damaged) until it snaps in place (when properly aligned, and making certain that the readout pin is clear, it may be desirable to press the connector shell on against the edge of a desk).

Readout Pin Replacement

To replace the readout pin in the BNC connector, pull the old pin out with a pair of needle-nosed pliers. Carefully insert the new pin assembly in its place while taking care not to bend or pinch the assembly with the pliers.

Probe Tip Replacement

To remove the probe tip, first unscrew the light grey probe body shell and slide off the grounding collar (refer to Figure 2-1). Then unscrew the probe tip from the cable assembly. The probe tip for the P6135 has small plastic end pieces that are color coded yellow at the tip end and transparent at the cable end to aid in distinguishing the P6135 tip from other subminiature probe tips. To install a replacement probe tip, simply reverse the procedure.

READJUSTMENT AFTER REPAIR

After any electrical component has been replaced, complete the "Performance Check Procedure" (Section 3) to verify that the probe is within specification limits. If adjustment is necessary, perform the appropriate "Adjustment Procedure" (Section 3).

INSTRUMENT REPACKAGING

If the probe is to be shipped to a Tektronix Service Center for service or repair, attach a tag to the probe that contains the following information:

1. Owner's name and address and the name of an individual that can be contacted.

2. Description of the service required.

To repackage the probe, use the original carton in which your probe was shipped. If the original packing is unfit for use or is not available, repackage the probe as follows:

1. Obtain a corrugated cardboard carton having inside dimensions that allow for at least 2 inches of cushioning around the probe. Use a carton having a test strength of at least 175 pounds.

2. Surround the probe with protective polyethylene sheeting.

3. Cushion the probe on all sides by tightly packing dunnage or urethane foam between carton and probe, allowing 2 inches on all sides.

4. Seal the carton with shipping tape or an industrial stapler.

REPLACEABLE PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number (if applicable).

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

INDENTATION SYSTEM

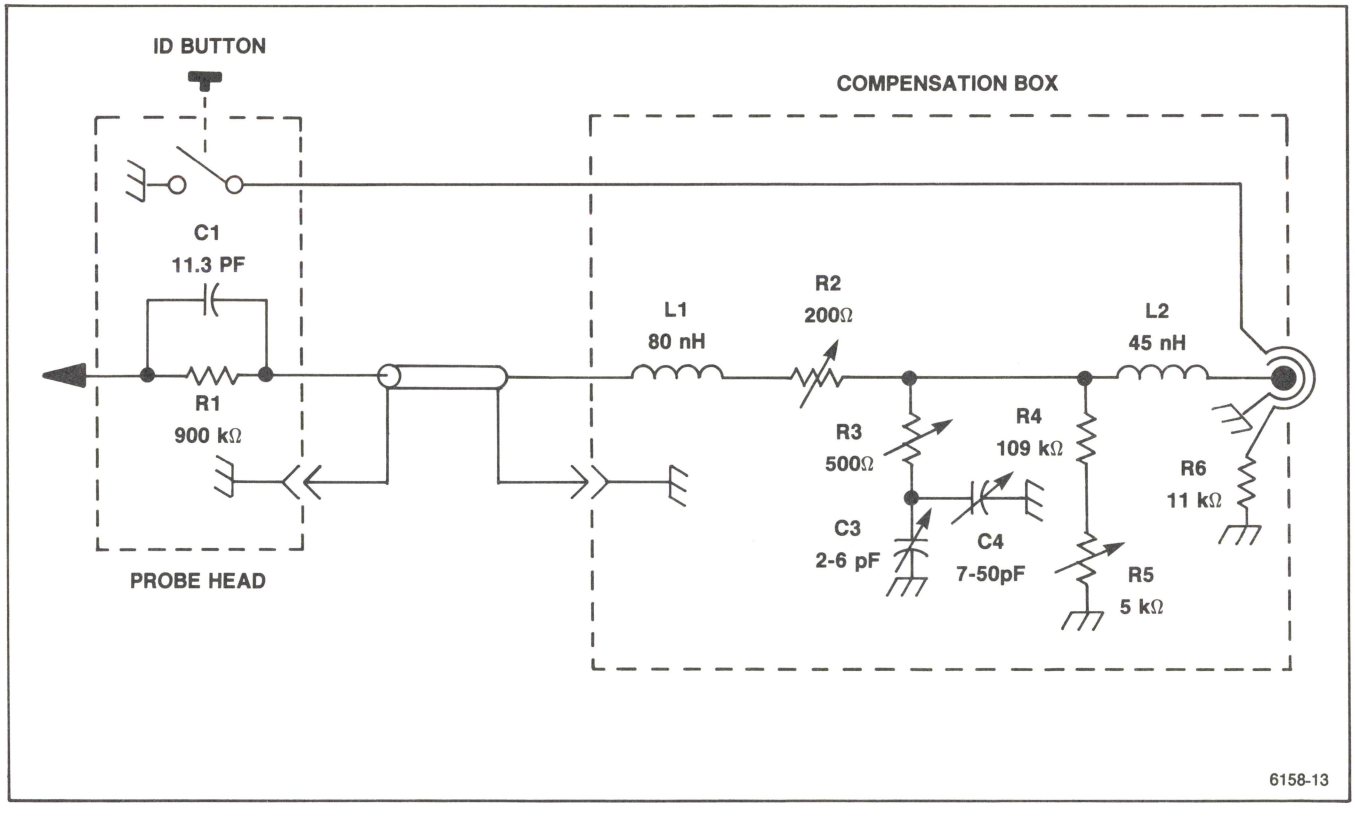
This parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5 Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component
\- - - * - - -
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
\- - - * - - -
Parts of Detail part
Attaching parts for Parts of Detail Part
\- - - * - - -

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented parts are part of and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

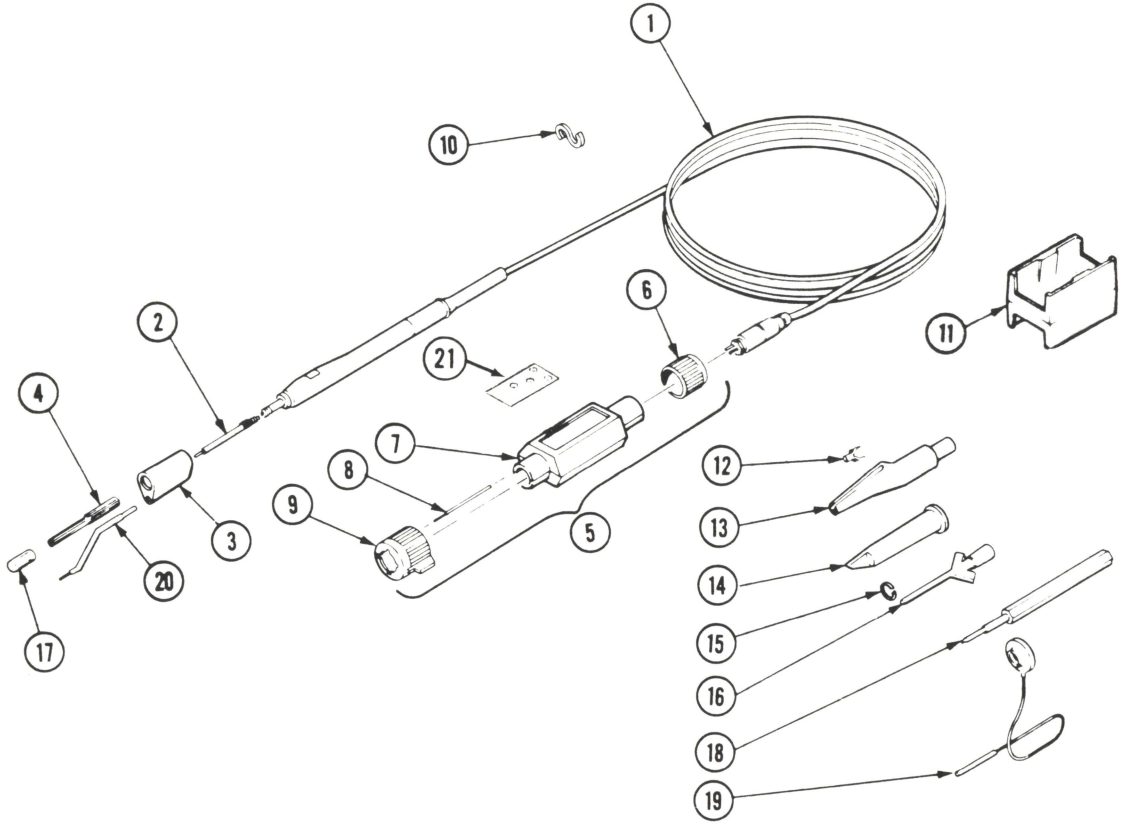

ID BUTTON
COMPENSATION BOX
C1
11.3 PF
R1
900 kΩ
PROBE HEAD
L1
80 nH
R2
200Ω
R3
500Ω
C3
2-6 pF
C4
7-50pF
R4
109 kΩ
R5
5 kΩ
L2
45 nH
R6
11 kΩ
6158-13

Schematic 1.

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077
TK1473	RICHARD HIRSCMANN OF AMERICA	PO BOX 229/INDUSTRIAL ROW	RIVERDALE NJ 07457
TK1556	CONSOLIDATED VINYL SALES	1237 S SAN GABRIEL BLVD	SAN GABRIEL CA 91776

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	174-0707-00			1	CABLE ASSY,RF:(CABLE PAIR) 1.5 METER	80009	174-0707-00
-2	206-0369-00			2	TIP,PROBE:900K OHM,11PF,10X	80009	206-0369-00
-3	343-1003-01			2	COLLAR,GND:	80009	343-1003-01
-4	204-0925-01			2	BODY SHL,PROBE:	80009	204-0925-01
-5	206-0368-00			2	COMP BOX ASSY:	80009	206-0368-00
-6	205-0193-00			2	.SHELL,CA BOOT:ABS,SLATE GRAY	80009	205-0193-00
-7	----- -----			2	.COMP BOX:1.5M		
-8	131-3685-00			2	.CONTACT,ELEC:SPRING TIP,GOLD	80009	131-3685-00
-9	205-0192-00			2	.SHELL,ELEC CONN:BNC,ACETAL,DOVE GRAY	80009	205-0192-00
					STANDARD ACCESSORIES		
-10	344-0408-00			12	CLIP,RTNG,CABLE:S CLIP,540,DARK GRAY,ZYTEL	80009	344-0408-00
-11	376-0223-00			1	CPLR,COMP BOX:ABS,FLINT GRAY	80009	376-0223-00
-12	131-2766-03			2	CONNECTOR,PROBE:W/SOCKET,DATA SHEET	80009	131-2766-03
-13	344-0398-00			2	CLIP,ELECTRICAL:ALLIGATOR,0.155 L,STL CS PL	80009	344-0398-00
-14	013-0208-01			2	TIP,PROBE:RETRACTABLE HOOK	80009	013-0208-01
-15	016-0633-00			2	MARKER SET,CA:2 EA,9 COLORS	80009	016-0633-00
-16	013-0217-00			2	GRABBER,IC LEAD:BLACK,2.047 L X 0.137 DIA	TK1473	973 592 500
-17	200-2747-00			2	COVER,PROBE TIP:	80009	200-2747-00
-18	003-1364-00			2	SCREWDRIVER:ADJUSTMENT TOOL,METAL TIP	80009	003-1364-00
-19	196-3113-00			2	LEAD,ELECTRICAL:STRD,26 AWG,6.0 L,0-N W/CLR	80009	196-3113-00
-20	195-4240-00			2	LEAD,ELECTRICAL:0.025 DIA,COPPER,2.3 L	80009	195-4240-00
-21	**334-6943-01**			2	**MARKER, IDENT, P6135**	80009	**334-6943-01**
	016-0708-00			1	POUCH,ACCESSORY:	TK1556	ZIP-6.25X9.25ID
	070-6158-00			1	MANUAL,TECH:INSTR,P6135	80009	070-6158-00
					OPTIONAL ACCESSORIES (NOT SHOWN)		
	013-0195-00			1	ADAPTER,CONN:BNC TO PROBE	80009	013-0195-00
	013-0197-00			1	KLIPKIT:(2)16 PIN CLIP W/(4)CONTACT GROUND	80009	013-0197-00
	017-0520-00			1	CONN,PLUG,ELEC:50 OHM COAX	80009	017-0520-00
	131-2766-01			1	CONNECTOR,PROBE:PACKAGE OF 100	80009	131-2766-01
	136-0352-02			1	SOCKET,PIN TERM:PKG OF 100	80009	136-0352-02



Replaceable-Parts Figure 1.